American Journal of Case Reports

e-ISSN 1941-5923
© Am J Case Rep, 2020; 21: e927077
DOI: 10.12659/AJCR.927077

Received: 2020.06.27
Accepted: 2020.09.17
Available online: 2020.09.25
Published: 2020.11.06

Surgical Treatment of Celiacomesenteric Trunk Aneurysm: Report of 2 Cases

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Conflict of interest: None declared

Case series
Patients: Male, 63-year-old • Male, 32-year-old
Final Diagnosis: Celiac artery aneurysm with a celiacomesenteric trunk
Symptoms: No symptom
Medication: —
Clinical Procedure: —
Specialty: Surgery

Objective: Rare disease

Background: Celiac artery aneurysm is very rare, and even is more uncommon in patients with celiacomesenteric trunks. With recent developments in diagnostic imaging, the detection of asymptomatic abdominal visceral aneurysms has increased. However, some abdominal visceral aneurysms are still first discovered after a rupture. An abdominal visceral aneurysm rupture can occur suddenly and lead to shock due to intraperitoneal hemorrhage. Two cases of celiac artery aneurysms that involved common celiacomesenteric trunks are presented.

Case Reports: Case 1 was a 63-year-old man who was referred to our facility for further study after a routine abdominal ultrasound identified an aneurysm in the superior mesenteric artery. Contrast-enhanced computed tomography (CT) scan revealed a 39-mm aneurysm in the celiacomesenteric trunk and its branches. Case 2 was a 32-year-old man who was referred to our facility after an abdominal ultrasound performed during a physical examination revealed a celiac artery aneurysm.

Contrast-enhanced CT revealed a 31-mm aneurysm in the celiacomesenteric trunk and its branches. In both patients, the aneurysms were proximally located, and the distinctive anatomy of the celiacomesenteric trunk made endovascular treatment difficult. Open replacement and reconstructive surgery was performed to repair the aneurysms with grafts from the great saphenous vein. Both patients had uneventful postoperative courses.

Conclusions: The optimal treatment for the patients described was open surgical repair because the lower risk of occlusion of the visceral branch made it safer and more reliable than an endovascular approach.

MeSH Keywords: Aneurysm • Aortic Aneurysm, Abdominal • Celiac Artery

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/927077

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Background

A celiacomesenteric trunk is an anatomical variation in which the celiac artery and the superior mesenteric artery branch from the aorta as a single common trunk. It is rare, accounting for approximately 1% of anomalies of visceral arteries.

Visceral artery aneurysms are rare and found in only 0.01% to 0.2% of the population. The splenic artery is the most common site of aneurysms (60% to 80%), followed by the hepatic (20%), gastroduodenal (6%), and superior mesenteric arteries (5.5%), whereas aneurysms are rarer in other arteries (celiac trunk 4%, gastric and gastroepiploic arteries 4%, pancreatic branches and jejunal and ileocolic arteries 3%, and inferior mesenteric artery 1%) [1]. Aneurysm of the celiomesenteric artery is extremely uncommon and occurs in only 0.25% of all visceral artery anomalies [2]. Causes of visceral artery aneurysms that have been identified include congenital and infectious diseases, trauma, arteriosclerosis, and iatrogenic factors, but the true etiology remains unknown [3].

The detection of asymptomatic abdominal visceral aneurysms has increased recently with developments in diagnostic imaging [4]. However, abdominal visceral aneurysms often are discovered when they rupture [5,6]. Rupture of an abdominal visceral aneurysm can occur suddenly and lead to shock because of intraperitoneal hemorrhage. In fact, visceral artery aneurysm is a high-risk condition; more than 20% of them represent a clinical emergency and more than 8% result in death [7]. Considering the high risk of rupture, surgical intervention generally is recommended for aneurysms >2 cm [8]. In addition, because the celiacomesenteric trunk is in close proximity to the pancreatic body, care should be taken not to injure the pancreas. No reports exist about surgical treatment of visceral artery aneurysms in patients who have a celiacomesenteric trunk anomaly. In this case report, we describe surgical treatment in 2 patients with celiacomesenteric trunks who had concurrent visceral artery aneurysms.

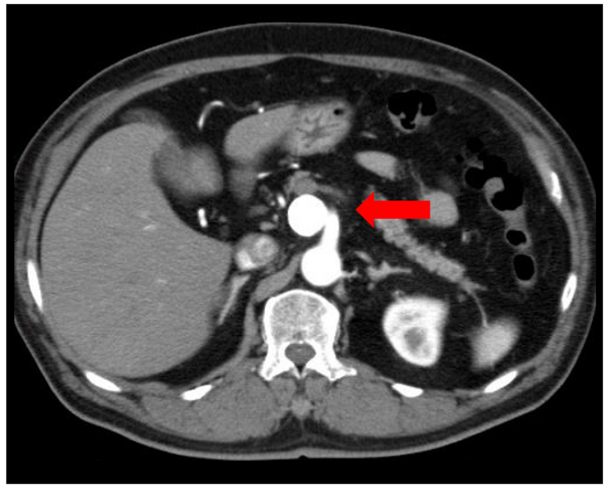

Figure 1. A contrast-enhanced abdominal computed tomography scan shows a 3.9-cm visceral artery aneurysm (arrow).

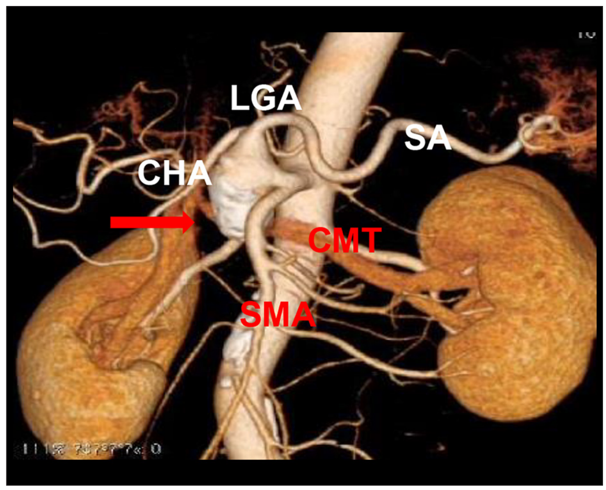

Figure 2. A 3-dimensional volume-rendered computed tomography scan shows the celiacomesenteric trunk (CMT). The CMT divides into the celiac artery (CA) and superior mesenteric artery. The common hepatic artery, splenic artery, and left gastric artery are seen arising from the CA. The visceral artery aneurysm (arrow) originated from the CA. CHA – common hepatic artery; LGA – left gastric artery; SA – splenic artery; SMA – superior mesenteric artery.

Case Reports

The proposal for this study was approved by the institutional review board at Juntendo Hospital, Juntendo University School of Medicine (approval number JHS 20-001, approval date June 20, 2020) and both patients provided written informed consent.

Case 1

The first patient was a 63-year-old man who was diagnosed with spinal stenosis at age 52 years but had no abdominal symptoms. He had no clear risk factors for aneurysm formation, such as a history of trauma, pancreatitis, arterial dysplasia, or systemic disease (for example, Takayasu's arteritis, Behçet's syndrome, Ehlers-Danlos syndrome, or Marfan's syndrome). There also was no family history of aneurysm.

The patient was seen at our facility after a routine abdominal ultrasound revealed an aneurysm in the superior mesenteric artery. Surgery was recommended that year when a contrast-enhanced computed tomography (CT) scan revealed a 39-mm aneurysm located in the celiacomesenteric trunk and its branch.

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On admission, the patient was 172 cm tall and weighed 86.2 kg, with a blood pressure of 130/80 mmHg. His abdomen was soft and flat with no masses, tenderness, or vascular murmurs. He had a history of smoking tobacco but not of substance abuse. All results from blood tests were normal.

According to his CT image, the patient had a celiacomesenteric trunk arising from his abdominal aorta. A 39-mm aneurysm was observed in the proximal area of the celiac artery, and extensive calcification was noted around the aneurysm. The patient was diagnosed as having an aneurysm of the celiac artery in a celiacomesenteric trunk (Figures 1, 2).

Although the man presented without symptoms, surgery was considered necessary because of the size of the aneurysm and the risk of death if it ruptured. Given the morphology of the celiacomesenteric trunk, reconstruction of the splenic, common hepatic, and superior mesenteric arteries was required to remove the aneurysm, therefore, open surgery was selected. Endovascular treatment was excluded from the therapeutic options because of the risks associated with arterial recanalization and of ischemic complications. The aneurysm was repaired with a saphenous vein graft (SVG) harvested from the patient's right lower extremity using 6-0 polypropylene (Figure 3). The surgery took 299 min and the patient lost 130 mL of blood but did not need a transfusion. He was discharged on postoperative Day 11 with no complications. Postoperatively, no increase in hepatic enzymes or pancreatitis was observed. One year after surgery, the man had no evidence of dilatation of the SVG or recurrence of symptoms. He organ has been preserved and is not ischemic.

Case 2

The second patient was a 32-year-old man with no significant medical history nor any clear risk factors for aneurysm formation, including family history of aneurysms.

The man had a history of smoking tobacco but not of substance abuse.

A physical examination of the patient was performed and an abdominal aortic aneurysm was observed on abdominal ultrasound. Surgery was recommended later that year, when a contrast-enhanced CT performed at our facility revealed a 30-mm aneurysm located in the celiacomesenteric trunk and its branch.

On admission, the patient was 162 cm tall and weighed 59 kg, with a blood pressure of 120/70 mmHg. His abdomen was soft and flat with no masses, tenderness, or vascular murmurs. Results of blood tests were normal.

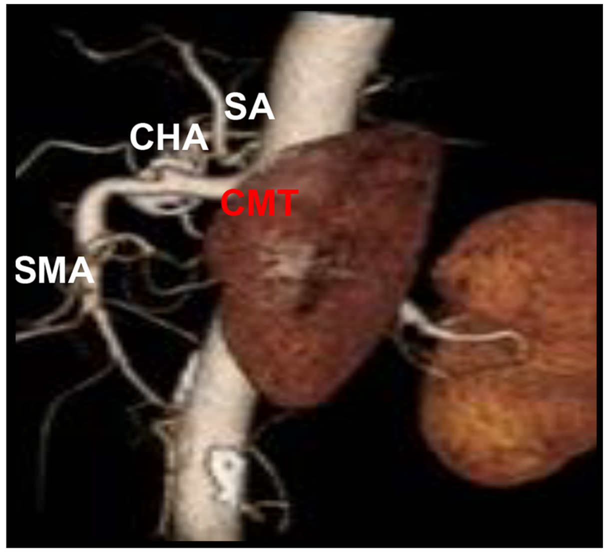

Figure 3. A postoperative 3-dimensional computed tomography scan shows that the resected aneurysm has been replaced with the saphenous venous graft. CHA – common hepatic artery; CMT – celiacomesenteric artery; SA – splenic artery; SMA – superior mesenteric artery.

CT imaging revealed that the celiac and superior mesenteric artery shared a common origin in the abdominal aorta. A 31-mm aneurysm was found on the proximal side of the visceral artery and at the distal divergence of the hepatic and splenic arteries. The diagnoses were visceral artery aneurysm and presence of a celiacomesenteric trunk (Figures 4, 5).

We chose to perform surgery on the patient in Case 2, as we did in Case 1, to prevent rupture of the aneurysm. Given the morphology of the celiacomesenteric trunk, reconstruction of the superior mesenteric, common hepatic, and splenic arteries was required to remove the aneurysm. Endovascular treatment was not an option because of the risks associated with arterial recanalization and potential for ischemic complications. A 5-cm SVG was harvested from the patient's left lower extremity and a patch was fashioned from it and affixed with 6-0 polypropylene for roof reconstruction. The reconstruction was completed with an additional venous patch (Figure 6). The surgery took 213 min and the patient lost 40 mL of blood but did not need a transfusion. He was discharged on postoperative Day 11 with no complications. Postoperatively, no increase in postoperative hepatic enzymes or pancreatitis was observed.

One year after the patient's surgery, the man had no dilatation of the SVG or symptoms. His organ has been preserved and is not ischemic.

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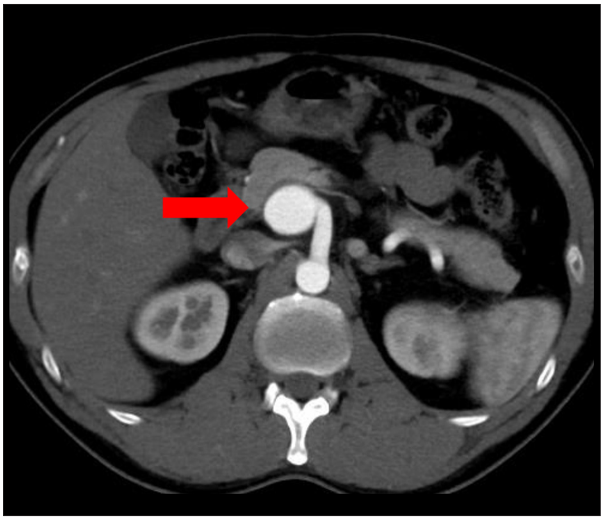

Figure 4. A contrast-enhanced abdominal computed tomography scan shows a 3.0-cm visceral artery aneurysm (arrow).

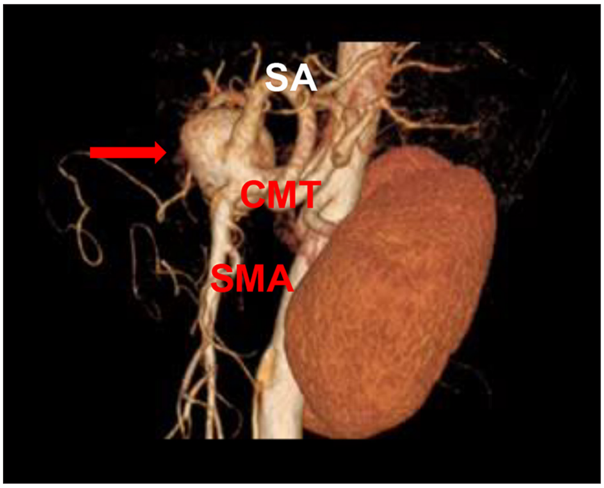

Figure 5. A 3-dimensional volume-rendered computed tomography scan shows the celiacomesenteric trunk (CMT). The CMT divides into the celiac artery (CA) and superior mesenteric artery. The common hepatic artery and splenic artery are seen arising from the CA. The visceral artery aneurysm (arrow) originates from the CA. SA – splenic artery; SMA – superior mesenteric artery.

Surgical procedure

In both the patients presented here, the surgical procedure began with exposure of the abdominal cavity through an upper midline incision. After mobilization of the duodenum, the omental bursa was entered through the greater omentum and the gastrocolic ligament. The retroperitoneum was resected and the renal vein and inferior margin of the pancreas was identified. The pancreas was mobilized and reached through the lesser sac portion of the pancreas. The superior mesenteric vein (SMV) was carefully harvested. In both cases, a 3-cm

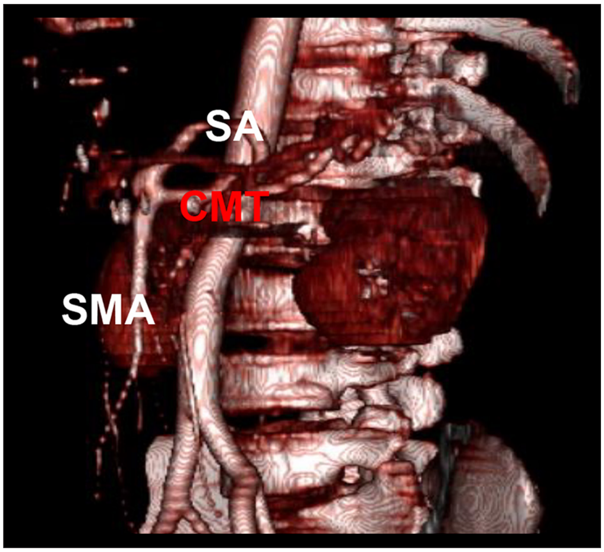

Figure 6. A postoperative 3-dimensional computed tomography scan shows the saphenous vein graft that was used as a patch for the roof reconstruction and that the aneurysm has been removed. CMT – celiacomesenteric artery; SA – splenic artery; SMA – superior mesenteric artery.

aneurysm was present on the celiac artery. The common celiacomesenteric trunk was carefully detached toward the dorsal side and taped, while the superior mesenteric, common hepatic, and splenic arteries were taped on the distal side. Each taped branch was clamped with 100 U/kg of heparin.

A 5- to 6-cm portion of the saphenous vein was harvested from each patient's lower leg. In Case 1, the resected aneurysm was repaired with the SVG using 6-0 polypropylene. In Case 2, the SVG was used as a patch for the roof reconstruction and aneurysm removal because the aneurysm was saccular. After gastric, intestinal, and hepatic revascularization, the blood flow in each branch was monitored (Ultrasonic flowmeters: VerlQ: Nippon BXI Inc., Tokyo, Japan), and the color of each organ was checked.

During the surgery described here, close monitoring was performed for organ ischemia and damage to the pancreas.

Discussion

A visceral artery aneurysm with a celiacomesenteric trunk is extremely rare, and reports are limited regarding treatment of them with open abdominal surgeries, either in clinical trials or after rupture. Generally, minimally invasive catheter embolization or laparoscopy is performed in these patients. However, In the 2 cases reported herein, there was concurrent involvement of the celiacomesenteric trunk, which required reconstruction

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of the trunk's direct or indirect arterial branches (superior mesenteric, common hepatic, and splenic). Therefore, in both cases, the treatment of choice was open abdominal surgery. Case reports of aneurysms in patients who have concurrent celiacomesenteric trunks are very rare, and documentation on surgery in such cases is even more limited [9–13].

Changes in the celiac and superior mesenteric arteries occur during the embryonic stages of development. From gestational weeks 4 to 7, ventral segmental arteries 10 to 13 reach toward the ventral aorta to form a longitudinal anastomosis. In the normal developmental course, the 11th and 12th segmental arteries and the longitudinal anastomosis regress. The celiac artery and superior mesenteric artery develop from the 10th and 13th segmental arteries, respectively. It is theorized that abnormal development of the celiacomesenteric trunk results when the longitudinal anastomosis remains and the 10th segmental artery regresses along with segmental arteries 11 and 12 [14–16].

Visceral artery aneurysms are generally asymptomatic until they rupture. In aneurysms that have been detected, the rupture rate per year is 2% to 10%, and the mortality rate after rupture is 10% to 25%. Because the mortality rate in patients who are pregnant or who have portal hypertension is even higher, prophylactic surgery is performed on them [17]. The goal of treatment for visceral artery aneurysms is to prevent rupture and exsanguination.

Treatment indications for a visceral artery aneurysm are not well established because of the lack of documented cases. Some reports suggest that surgery should be performed for aneurysms with a diameter 3 to 4 times larger than that of the original vessel, aneurysms 3 cm with calcifications, and those that are significantly dilated [17,18]. However, morphology alone cannot be used to predict rupture of a visceral artery aneurysm, which can occur regardless of the diameter. Some studies have suggested that, given the increased risk of rupture, aneurysms should be treated regardless of their diameter if they are located in the gastroduodenal or pancreaticoduodenal arteries or branches of the superior or inferior mesenteric artery [19–21].

The American College of Cardiology/American Heart Association guidelines indicate that aneurysms >20 mm should be treated (Class I, level of evidence B) [22]. Earlier reports generally recommended treatment for aneurysms >20 mm, provided that the overall condition of the patient is satisfactory [23]. Another sign that treatment is needed is presence of symptoms or dilation. In addition, aneurysms in women of childbearing age require treatment because of the higher risk of rupture [24]. Visceral artery aneurysms are reported to have a higher risk of rupture, particularly during the perinatal period, possibly as a result of portal hypertension, obstruction of the arterial elastic fibers caused by pregnancy-induced changes in estrogen secretion, abdominal pressure elevation, and hemodynamic changes due to increased circulating volume [20,23]. In addition, aneurysms in the pancreaticoduodenal artery or other branches of the superior mesenteric artery call for surgery regardless of their size because the mortality rate is 50% if they rupture [17,19].

Because of recent advances in diagnostic imaging, more asymptomatic visceral artery aneurysms now can be detected. Contrast-enhanced angiography used to be the most useful imaging method for diagnosis, but it is invasive and time-consuming. With multidetector computed tomography (MDCT), diagnosis is easier and more accurate. The amount of information obtained using MDCT approaches that for contrast-enhanced magnetic resonance angiography (CE-MRA), which makes it a useful tool in treatment planning. With CE-MRA, smaller vessels can be seen and transitioning from it to transcatheter arterial embolization is easy. Ultimately, medical providers should select the imaging method most appropriate for a particular patient.

In some cases, excision or reconstruction of neighboring organs is required during surgery for a visceral artery aneurysm. The procedures vary, according to the size or location of the aneurysm. To ensure optimal timing for such an operation, it is critical for the cardiovascular surgeon to communicate with other departments.

Currently, the treatment of choice for a visceral artery aneurysm is open surgery if revascularization is required and endovascular treatment if it is not. We believe that endovascular treatment should be the first choice for all aneurysms. However, in cases where multiple branches diverge from the aneurysm, open surgery would be the treatment of choice because of the potential for intestinal ischemia. As discussed in recent reports about concurrent stent grafting and coil embolization [25,26], a wide variety of endovascular treatments are available.

The 2 cases in the present report involved the common trunk, and the superior mesenteric artery had to be preserved in both patients. Open surgery was performed because complete preservation using endovascular treatment would have been challenging, given that the splenic and hepatic arteries branch directly from or immediately after the visceral aneurysm.

In renal artery aneurysms, patch repair, replacement, bypass, or reconstruction generally is performed using autologous vein grafts such as with the great saphenous vein via end-to-end anastomosis, and long-term patency has been reported [27–29]. Reports exist about reconstruction of the visceral

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arteries of the common trunk with venous grafts, but long-term outcomes have not yet been documented.

Considering the documented favorable long-term patency of SVGs used procedures to repair renal artery aneurysms, the great saphenous veins have been used in revascularization in the cases that have been reported.

Conclusions

In conclusion, we believed that open repair, which is associated with a lower risk of visceral branch occlusion, was safer and more reliable than an endovascular procedure – and thus optimal – in the cases presented here. After an abdominal visceral aneurysm is repaired with an SVG, follow-up with MDCT is possible.

Acknowledgements

The authors thank Enago (*www.enago.jp*) for English language editing of this manuscript.

Conflict of interest

None.

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